A SYSTEM AND METHOD FOR FILTERING CONTENT

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5   **CROSS-REFERENCE TO RELATED APPLICATION**

This application relates to co-pending United States patent application Serial No. 09/946,112, attorney docket number 40.0041, filed on September 4, 2001, entitled System and Method for Caching Content and naming Irwin Pfister, Michael A. Montgomery, and Bertrand du Castel as inventors, the application being incorporated herein by reference for all 10 purposes in its entirety.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to the field of filtering content, and, more particularly, to a filtering system and method for content using a gateway.

Description of the Related Art

Computers are often connected together in a network so the computers can share data. When information is transferred between computers, a computer predominantly responsible for sending data is often referred to as the host or server computer. A computer that predominantly receives the data is sometimes referred to as the receiving or client computer.

20   Current technological limitations sometimes slow the transfer rate of data between computers. The term "transfer rate" describes the amount of time that it takes for one computer to send a given amount of information to another computer. Using a slow transfer rate, a computer takes a relatively long time to transfer a given amount of information to another computer. Slowed transfer rates can normally be attributed to mechanical issues, to 25 technological limitations in electrical components, and to the sheer volume of information server computers transfer in complex networks.

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One way to lessen the impact of slow transfer rates is through caching. Caching describes the practice of storing recently used data in a receiving computer's local memory after the data is transferred to the receiving computer. Caching can allow faster overall access time to data being retransmitted because the receiving computer can normally access its local memory much faster than it can get retransmitted data from the sending computer.

A caching system is normally limited because the amount of memory allocated to the cache is generally too small to hold all data that is ever transferred. Once a cache is filled and new data comes in, a caching system must decide which data to keep and which data to overwrite. Caching systems use different techniques in deciding which of the transferred data to store in cache and which data to delete. The underlying strategy is to somehow predict future data needs so the receiving computer can access more data from cache and less data through time-consuming transfers across a network. One common method is to use a Least Frequently Used (LFU) approach. In this system, as new data comes in, the least often asked for data in cache is discarded. Another common caching system is based on the Least Recently Used (LRU) approach. That is, as new data comes in to be stored in cache, the system throws away the data that was requested the longest time previously. In essence, as the name suggests, the LRU approach discards the data that has been accessed least recently.

Another limitation for caching systems is the granularity of the information being cached. For the cache to be effective, the data in the cache must precisely match the data that would otherwise be transferred. If even a single bit of the data does not match, the content stored in the cache is useless. Thus, a document cached as a single large file would need to be retransmitted in its entirety if even a single letter is changed.

Yet another limitation for caching systems is the mechanism for identifying whether the cached contents matches the data on a remote machine. In many cases, the matching is based on a date stamp. If the date stamp matches, the cached contents can be used. If it does not, then entirely new contents must be downloaded. Often the date stamp comparison is limited to the main file, so that if the main is marked as changed, all subfiles must also be downloaded. Thus, the benefits that might otherwise be derived from small granularity are lost since the cache cannot determine which subfiles useful and, therefore, all subfiles must also be downloaded.

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Caching systems are used when a receiver computer receives information from a server using the Internet. The Internet in general is a complex, world-wide collection of computer networks. The Internet works on the client/server model of information delivery. The Internet makes it possible for computers world-wide to share information and messages.

There are numerous ways for a user to connect to the Internet. Individuals often link to the Internet by connecting to an Internet service provider (ISP) using a modem and a phone line. Other popular means for individuals to connect to an ISP include using a cable modem or a wireless system. Hand-held devices, such as wireless telephones and personal digital assistants (PDAs), are often linked, using various technologies, to the Internet for sending and receiving information. Some users access the Internet through a television set using WebTV. In short, there are ever-increasing ways, not limited to computers, to access the Internet.

The World Wide Web (web) is a popular protocol for accessing information from the Internet. On the web, information is stored in documents on web sites that are usually accessible to other users on the web. To access information on the web, a user needs a web client, more commonly called a browser. The browser sends instructions to a server computer on the web and retrieves a specific Web document or page. The browser allows a user to access different web sites, download information from the web site, and display the information on the users local computer.

Today, a browser allows a user to access different sites on the web by using a universal resource locator (URL). The URL is essentially an address to tell the browser where to go to get information. Information is stored at the URL address in what is commonly referred to as a web page. Sometimes, a web page contains more than one file that may be displayed side by side. In this case, each individual file is called a "frame" and each frame has its own URL.

One example of such a server is referred to as a web server. The web server is responsible for sending data, such as web pages. When a receiving computer requests a web page, the files that make up that web page are downloaded using the limited bandwidth of the communications equipment and the limitations of the web server. In one caching scenario, a web browser on the receiving computer saves time by using cache to store old files related to the requested web page. The receiving computer only downloads the newest data associated with the requested web page. The practice of storing old files is commonly referred to as

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"web page caching." Web page caching reduces the volume of data that a web server supplies the receiving computer because old pages already stored in cache are not downloaded again. The reduction in the volume of data sent reduces the transfer rate of a given number of pages. Also, web page caching results in reduced accessed times for

5   receiving computers because web servers can handle reduced output volumes more rapidly than higher output volumes.

Web browsers generally combine the functions of fetching data in a file, figuring out where the data is, and displaying some of the data. A web browser uses a standardized interface protocol, such as HyperText Transfer Protocol (HTTP) or, as in the case of wireless

10   connections, Wireless Application Protocol (WAP), to make a connection via the Internet to other computers known as web servers, and to receive information from the web servers that is displayed on the user's display. Information displayed to the user is typically organized into pages that are constructed using a specialized language such as Hypertext Markup Language (HTML), Extensible Markup Language (XML), and Wireless Markup Language (WML), hereinafter jointly referred to as "markup languages."

Markup languages are typically based on the Standard Generalized Markup Language (SGML). SGML is a standard language for defining the format in a text document that allows sharing of documents among computers, regardless of hardware and operating system configurations. WML is used for wireless networks and is an XML application based on

20   HTML and SGML. Markup language files use a standard set of code tags embedded in text that describes the elements of a document. The web browser interprets the code tags so that each computer having its own unique hardware and software capabilities is able to display the document while preserving the original format of the document. An SGML document uses a separate document type definition (DTD) file that defines the format code tags embedded

25   within the file.

Web pages are stored in a markup language format. A browser decodes symbols in web documents, turning them into formatted documents with graphics and text. Two general parts of a markup language file include text, which is displayed word for word on a web page, and markup information that contain display information such as normal text, colored

30   hypertext, or bold headers. Markup language files may also contain many other kinds of information, such as elements, tags, anchors, hyperlinks, URL's and attributes.

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Other programming languages are used with, or instead of, HTML, WML and XML to enhance web browsing. For example, Java is a language that can be used to add animation and real-time interaction to a Web site.

When downloading data from a web page, often a large percentage of the data is relatively static in nature. For example, when downloading a typical web page such as www.yahoo.com, more than 90% of the content is the same from week to week. However, each time the page is downloaded, all data from the page is usually downloaded, including the information that has not changed since the last download, since the caching is based on the date stamp of the main page. If the data stamp on the main page has changed, reflecting any change whatsoever to the web page, the entire contents of the page must be downloaded again. Current web caching strategies based on LFU and LRU algorithms using date stamps are not adequate. Furthermore, network bandwidth is becoming more and more of a premium. In particular, many mobile computing devices connect to a network using a wireless channel with very limited capacity or with a fee based on the amount of data transferred. Accordingly, there is a need to reduce the amount of bandwidth used during downloads by reducing the amount of unnecessary information that is downloaded.

One efficient system and method for caching data was introduced in U.S. Patent Application Serial Number 09/946,112, to Irwin Pfister, et al., (hereinafter *Pfister*) which is cross-referenced above and incorporated herein for all purposes. The *Pfister* system and method described a method of caching that included determining characteristics of content and caching according to those characteristics. What is needed is a system and method that further addresses concerns for efficiency and cost-effectiveness with regard to caching and data management, and addresses a gateway implementation for managing content.

SUMMARY OF THE INVENTION

Accordingly, a system and method for reducing transmissions of content between a gateway and one or more clients includes determining a plurality of characteristics of content, including at least one static characteristic of content, and sharing the determination of the plurality of characteristics of content with the gateway and the one or more clients. The sharing enables the gateway to filter content for transmission to the one or more clients based on the plurality of characteristics thereby reducing an amount of content for transmission between the gateway and the one or more clients.

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The method includes updating the gateway with a later determination of the plurality of characteristics of content, the updating including adding data to a container, such as a database. The determining can be done prior to manufacture of one or more components for the client or after manufacture of the one or more components for the client, the client or the gateway performing the determining according to decisions by one or both of the client and the gateway. The decisions can include a decision that an identified content type will be cached in the client and require updating according to a predetermined frequency; a decision regarding a number of bytes for each transmission; a decision regarding an amount of time for a transmission; a contractual agreement regarding reduced transmissions; a decision made via a setup program for governing transmissions; and/or a decision with respect to a static characteristic of a linked set of files for a web site, the linked set of files having a hierarchy, wherein the linked set of files is shared with the gateway with the static characteristic determining the filtering of the content.

One embodiment of the method includes recording one or more unique identifiers associated with the determination of the plurality of characteristics of content, the unique identifiers identifying content chosen for caching according to at least one characteristic of the plurality of characteristics of content. In the embodiment, the method further includes comparing the unique identifiers to a container of unique identifiers recorded by the gateway. If the container holds the unique identifier, the method includes transmitting to the client the content as filtered by removing content identified by the unique identifier.

Another embodiment is directed to a method of managing content in a gateway. The method includes: reading a container, the container identifying content not to be distributed according to at least one characteristic of the content; comparing the container with received content for distribution to a client; and if the container identifies the received content as including one or more subsets of content identified as not to be distributed, filtering the subsets from the content. The subsets can be identified via one or more unique identifiers that match unique identifiers in the client referencing cached content. In one embodiment, the gateway has a contractual relationship with the client. The at least one characteristic of the content can include a plurality of characteristics according to one or more of a determination as to a level of inactivity and a plurality of predetermined parameters for adjusting the content.

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One embodiment of the method provides that the content is stored on a machine readable medium coupled to a first digital machine. The first digital machine transmits content via a communication channel to a second digital machine wherein: the characteristic of the content associated with the container is a static characteristic; the comparing includes determining whether the container identifies content for distribution to second digital machine that is held in a cache of the second digital machine; and, if the second digital machine cache holds content identified in the container, the content is stored in a readable/writeable memory locally coupled to the second digital machine. The second digital machine can be configured to execute one or more of telephony, appointment planning, and personal computing.

An embodiment is also directed to a system including a processor, a first memory coupled to the processor, a first instruction set operable with the processor to compare a container in the first memory to determine whether content for transmission matches at least a subset stored in a second memory within a receiving device, wherein the subset is identified as one or more of static content previously cached in the receiving device and content previously identified as not to be transmitted to the receiving device, and a second instruction set operable with the processor to filter the content for transmission by removing the subsets. In one embodiment, the first memory includes storage for the content with the static characteristic and a database for holding a list of unique identifiers.

In one embodiment, the system is a gateway configured to transmit filtered content to the receiving device. Further, the second instruction set can further insert a plurality of unique identifiers into the filtered content, the plurality of unique identifiers marking the filtered content for the receiving device to insert cached content. In one embodiment, the receiving device is one of a smart card and a memory module coupled to one of a mobile telephone, a personal digital assistant, a personal computer, and a mobile computing device. The receiving device, in an embodiment, receives the plurality of unique identifiers via a communication channel in response to a request for content for loading a linked set of files defining a web page, the linked set of files including content having a static characteristic and dynamic content, wherein the content identified as having at least one static characteristic is associated with the plurality of unique identifiers. The linked set of files can include a ranking means for ranking the content as having a static characteristic and content having dynamic characteristics according to how often the content is likely to be replaced.

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BRIEF DESCRIPTION OF THE DRAWINGS

The present invention may be better understood, and its numerous objects, features and advantages made apparent to those skilled in the art by referencing the accompanying drawings. The use of the same reference number throughout the several figures designates a like or similar element.

Figure 1 illustrates a network showing content flow according to an embodiment of the present invention.

Figure 2A illustrates a block diagram of a method for the transmitting content according to an embodiment of the present invention.

Figure 2B illustrates a block diagram of a method for a gateway configured to transmit content according to an embodiment of the present invention.

Figure 3 illustrates an embodiment of a network for showing Internet content according to an embodiment of the present invention.

Figure 4 illustrates a sample web page appropriate for implementing embodiments of the present invention.

Figure 5 illustrates a flow diagram of an embodiment of a method for identifying content according to an embodiment of the present invention.

Figure 6A illustrates a flow diagram of an embodiment of a method for a gateway according to an embodiment of the present invention.

Fig. 6B illustrates a flow diagram of an embodiment of a method for receiving content according to an embodiment of the present invention.

Figure 7 illustrates a computer system appropriate for embodiments of the present invention.

DETAILED DESCRIPTION

The following description provides a detailed description exemplary of the invention and should not be taken as limiting of the invention itself. Rather, any number of variations

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may fall within the scope of the invention that is defined in the claims following the description.

The present invention relates to a method and system for reducing transmissions of content between a gateway and one or more clients and includes caching content through determining characteristics of the content and identifying the content for caching purposes based on those characteristics. There is a plurality of environments for which caching based on characteristics of the content efficiently enhances transfer rates and system performance. This is in contrast to conventional systems that cache based on properties that are independent of the contents of the file, such as date stamps or file names. For purposes of this disclosure "characteristics of the content" shall mean characteristics inherent to the content and relative to caching, independent of metadata such as file names, date stamps and the like.

The embodiments described herein refer variously to the terms client, server, gateway, and platforms for each. As used herein the term client should be broadly construed to mean a receptor of services, and can be conceptualized as software, firmware or the like, that runs on a client platform. A client platform should be broadly construed to mean any information handling system, computer, including microcomputer, computer platform, an adjunct to an information handling system, computer or platform or any component thereof. A client platform may be any generalized information appliance having a processor, an operating system, optionally a browser applications and be connectable to a computer network from which data may be retrieved. Appropriate appliances include, without limitation, any handheld device, network computer, computer terminal, and the like. A client platform can further be an information handling device that includes an x86, RISC or CISC-based processor, M6800-type processor, an operating system such as Windows®, UNIX®, LINUX® or other, a browser such as Netscape Communicator®, Internet Explorer®, MOSAIC® or other browser. A server should be broadly construed to mean a provider of services, and can be conceptualized as software, firmware or the like, that runs on a server platform. A gateway should be broadly construed as a specialized server that receives data and provides services to a client and can act as a gateway between a network and a client. A server platform and a gateway platform should be broadly construed to mean any information handling system, computer, including microcomputer, computer platform, an adjunct to an information handling system, computer or platform or any component thereof. A server

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platform can include a computer running a Windows®, UNIX®, LINUX® or other operating system appropriate for providing services to clients.

Referring to Fig. 1A, one embodiment is directed to a computing environment, specifically, an Internet computing environment. In the embodiment, server 130 is linked to a network to practice the invention. Included within server 130 is a transmitting device, such as a modem to direct a network connection to a remote server via a telephone link, wireless link, satellite link or the like, or to the Internet via internet service provider (ISP) 150. One embodiment may be directed to a direct connection to a remote server via a direct network link such as a direct link to the Internet via a POP (point of presence). The wireless techniques for connecting to the Internet or other location may include a digital cellular telephone connection, a Cellular Digital Packet Data (CDPD) connection, and a digital satellite data connection or the like.

When server 130 connects to the Internet, server 130 is able to access and/or download information using, for example, a web browser. An example of the type of information accessed includes the pages of a web site hosted on by the server 130, shown as web page 100(1). Protocols for exchanging data via the Internet are well known to those skilled in the art. While the Internet can be used by server 130 for exchanging data, the present invention is not limited to the Internet or to any network-based environment and, as described above, may operate in a stand-alone environment wherein transmission of content is performed between a server and another entity.

The web browser running on server 130 can employ a TCP/IP connection. Server 130 may run, for example, an HyperText Transfer Protocol (HTTP), Wireless Application Protocol (WAP) or other appropriate type of "service" (e.g., under the WINDOWS® operating system) or a "daemon" (e.g., under the UNIX® operating system), for example. WAP is a transport protocol similar to HTTP, which works over different kinds of networks. WAP generally takes less bandwidth than HTTP or similar non-wireless protocols. Server 130, then may employ a protocol that can be used to communicate between to a client, such as a client digital device (CDD) running a client digital service (CDS) 170. The server 130 responds to any requests received by a CDS 170, typically by sending a web page formatted as an hypertext markup language (HTML) file when the service is HTTP, extensible markup

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language (XML) file, wireless markup language (WML) file when the service is WAP, or any markup language appropriate for a web page.

The web browser interprets the file and may form a visual representation of the file using local resources of the given CDS 170, such as locally available fonts and colors. Further, server 130 and CDS 170 may support a number of Internet access tools, including, for example, an HTTP-compliant web browser having a JavaScript interpreter, such as Netscape Navigator®, Microsoft Explorer® and the like.

In one embodiment, CDS 170 and server 130 communicate via a wireless network using Wireless Application Protocol (WAP) and Wireless Markup Language (WML) web pages. WML is designed for wireless uses because WML delivers a limited subset of markup properties with web text, based on the World Wide Web Consortium (W3C) guidelines for mobile access. WAP provides a universal open standard for providing Internet content and other services to mobile phones and other wireless devices. In an example, CDS 170 shown in Fig. 1A may operate under a WAP standard when CDD 172 is implemented as a mobile phone or personal digital assistant (PDA) and display WML web pages received via a wireless network.

The conceptual computing environment of Fig. 1A shows server 130 coupled to transmit web page 100(1). Web page 100(1) includes content with different characteristics. In one example, web page 100(1) holds non-static content 110(1) and static content 120(1). In the example, infrequently changing static content is cached in CDS 170, and the more frequently changing non-static content is not cached. Although other characteristics of the content may be appropriate for distinguishing content on a web page, in one embodiment, the static characteristic advantageously provides criteria for caching different portions of a single web page. The definition of a static characteristic may be according to design requirements, allowing multiple levels of a static state. For example, whether content is static or dynamic may be a binary determination. In other embodiments, static content may include subsets related to other caching schemes, such as static content with subcategories, as will be appreciated by those of skill in the art with the benefit of this disclosure. Conversely, the dynamic characteristic of may include multiple levels of a dynamic state.

Server 130 is shown coupled to a network 150, which may include one or more Internet Service Providers (ISPs). Server 130 is coupled via a transmission vehicle 140. In

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other embodiments, the network and the server 130 may not require a separate transmission vehicle 140. For example, if the server 130 includes network functionality, server 130 directly communicates with clients.

Fig. 1A further shows a second transmission vehicle 154 between network 150 and Gateway 152. Gateway 152 is coupled via a third transmission vehicle 160 to CDS 170. Gateway 152 may alternatively be coupled to server 130 via transmission vehicle 140 or, Gateway 152 may act as a gateway/server combination and remain within the scope of the present invention.

CDS 170 includes a web browser 180 that is configured to display web page 100(2). Web browser 180 can be configured as stored on the CDD 172 in a smart card, on a permanent processor device within CDD 172 or within any type of removable or permanent processor. Web page 100(2) is configured to receive and display via web browser 180 non-static content 110(2) and static content 120(2). According to an embodiment of the present invention, CDS 170 includes at least a cache 190 and, in some embodiments, a cache index 192. Cache 190 and cache index 192 are coupled to enable identifying cached content associated with an identifier, which can be a unique identifier, within cache index 192.

In an embodiment, static content 120(2) includes an identifier that is compared with the cache index 192 to determine if the static content is already present in the cache. If the static content 120(2) is already present in the cache, the static content 120(2) is not transmitted by Gateway 152. Instead, the web browser 180 retrieves the static content 120(2) from the cache 190. Otherwise, the static content 120(1) is transmitted by Gateway 152 or server 130 and is stored in cache 190, and the cache index 192 is updated to include the identifier associated with static content 120(2).

In contrast, a conventional approach requires a change to the non-static content 110(1). The change would be reflected in a new date stamp for web page 100(1), thus requiring a later transmission of the entire page, including the static content 120(1), even if the cache already held static content 120(2).

Referring to Fig. 1B, the conceptual block diagram of Fig. 1A is shown implemented in a possible configuration. More particularly, Fig. 1B shows a server platform 131 that performs server 130 functionality. Server 130 is shown including a web page 100(1). Web

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page 100(1) can originate or be transmitted to server platform 131 via a transmission vehicle (not shown). Fig. 1B further shows network 150 coupled to both server platform 131 and gateway platform 153 via transmission vehicle 140 and 154, respectively. Gateway platform 153 receives web Page 100(1), gateway 152 performs gateway functions, and transmits data to Client Digital Device (CDD) 172.

Although CDD 172 is shown as a personal digital assistant (PDA), CDD 172 can also be a second computer, a hand held device, such a mobile telephone with Internet functionality, a mobile Internet device, or the like. CDD 172 is shown including CDS 170 and a web browser 180 configured to display web page 100(2), which can be a copy of web page 100(1) as received via transmission vehicle 160 or be a filtered version of web page 100(1). In one embodiment, the web page 100(2) is a copy of web page 100(1) and web page 100(2) holds non-static content 110(2) and static content 120(2) as defined in files and data associated with web page 100(1). In other embodiments, web page 100(2) is a reduced version of Web page 100(1) as described below.

The transmission vehicle 160 shown between Gateway platform 153 and CDD 172 can be a wireless communication vehicle. The wireless communication vehicle can operate according to one of a plurality of wireless standards, such as Bluetooth (also called Wi-Fi), 802.11b, 3G, and others. In general, Bluetooth is a short-range radio technology that links devices for automatic data exchange. 802.11b is an intermediate-range wireless networking standard that runs at speeds comparable to standard Ethernet. 3G is a cell phone technology, with a range of several miles from a cell tower or a repeater station, intended for broadband cell phone connections.

Referring now to Fig. 2A, a flow diagram according to an embodiment of the present invention describes one method of caching based on content characteristics. Block 210 provides for loading a web page. For example, CDS 170 may load a web page via transmission vehicle 160. Block 220 provides for analyzing the content of the Web page, such as Web page 100(2). Specifically, in one embodiment, the analysis includes determining whether there is static content in the Web page. If there is no static content, or if there is no content identified according to a specific characteristic or characteristics, block 230 provides for continuing the loading of the web page and further processing as is known. If there is static content in the web page, block 240 provides for checking for a static content

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identifier. In one embodiment, the static content identifier is a unique identifier determined by a content provider or a party with the responsibility of determining the characteristics of the content.

If one or more static content identifiers are found in block 240, block 250 provides for matching the static content identifier to a list of static content identifiers in a cache index, such as cache index 192. If cache index 192 holds the static content identifier, block 260 provides for loading static content from cache, such as cache 190 shown in Fig. 1A. In one embodiment, the cache 190 from which static content is loaded is a separate static cache, with an associated static cache index. As one of skill in the art appreciates, a static cache will be according to design requirements, taking into account factors such as the allowable memory available in a CDD 172. After loading the static content, the method continues by returning, as shown by line 262, to analyze the content received in a loaded web page 220.

If, at block 250, no static content identifiers are found in a cache index, block 270 provides for downloading static contents and storing the static contents in cache 190. Block 280 provides for updating the cache index to include an identifier associated with the stored static contents stored in cache. The method continues, as shown by line 282, with continuing the analyzing of content of the web page. If no further static content is found, the method ends upon completion of locating all identified static content. As will be appreciated, the method may repeat for each web page and each sub-portion of a web page as needed.

In one embodiment, the method of Fig. 2A provides that static content portions of various web pages are cached the first time they are read, either in a smart card or on a disk, or other storage device, or on a combination of storage devices. Upon each subsequent reference, only the dynamic content is downloaded. In the embodiment, the dynamic content identifies the static content upon which the dynamic content is built. If the cached static content matches the identification, the cached static content is loaded along with the dynamic content to present the web page. Otherwise, the cached version of the static content is refreshed with a current version of the static content.

Referring now to Fig. 2B, an embodiment is directed to a gateway, such as Gateway 152. In the embodiment, Gateway 152 is configured to operate with CDS 170 to transmit content in accordance with predetermined parameters. The predetermined parameters can include governing the content transmitted, converting the content transmitted, limiting the

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content transmitted, transmitting content according contractual or predetermined arrangements, and the like. In block 211, Gateway 152 receives content for delivery to CDS 170. The content can be in the form of a web page for delivery to CDS 170. In block 221, Gateway 152 manages the content prior to delivering the content to CDS 170. More particularly, as shown in block 231, Gateway 152 compares content data elements with a container. The container can be a list of content data elements in a file, a database or other appropriate container for data elements, such as, for example, a static file list. In another embodiment, Gateway 152 compares subsets of content, such as groups of content data elements, with a container of grouped content data elements or other elements associated with content data elements to determine whether to deliver the groups of content data elements to CDS 170. In one embodiment, Gateway 152 additionally or in lieu of comparing, applies rules for determining static content to the content data elements via, for example, a software program. The comparing and the rules accomplish identifying static content and dynamic content.

In block 245, Gateway 152 marks the content with unique identifiers. The unique identifiers identify content cached in CDS 170, for example, as described above with respect to Fig. 2A. In block 251, Gateway 152 transmits the filtered content. Gateway 152 transmits the content to CDS 170, or, as will be appreciated by one of skill in the art, Gateway 152 alternatively transmits the content to one or more intermediary network nodes, routers, or other entities which ultimately transmit the content to CDS 170.

The management of the content can include filtering related to a static/dynamic filter. For example, in one embodiment, when Gateway 152 compares the content, such as content for a web page, for transmission to CDS 170 with data in a container that identifies static content. The container can be a file, a static file list, a database or other appropriate container identifying static content. Gateway 152 also removes content data elements, files, or groups of content data elements identified in the container as already cached in CDS 170. In an embodiment, the cache in CDS 170 can be within a smart card. The smart card can be pre-loaded at manufacture for use within CDS 170. The data in the smart card is known to and/or provided by Gateway 152 at manufacture. Alternatively, the container that identifies static content to be filtered can be generated after smart card manufacturing.

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Gateway 152 can determine which content data elements or groups thereof should be cached in the smart card and download those files for caching at any time. Thereafter, Gateway 152 suppresses those content data elements previously downloaded to the CDS 170. The determination of content data elements appropriate for filtering may be according to a history of the user of the CDS using the smart card, a setup program identifying a user's preferences, a contract with a user for filtering content based on transmission charges and time for transmission contractually available to the user and the like. Thus, the suppression of and determination of static content can be according to a user's perspective. For example, Gateway 152 can determine the amount of content to filter based on a time for transmission or an amount of bytes for transmission to CDS 170. The more dynamic content can have a heightened priority for transmission. A user of CDS 170 can indicate to Gateway 152 that no transmission should take longer than a predetermined amount of time or a predetermined number of bytes, or both. Gateway 152 responds to the indication by dynamically filtering static content according to the predetermined amount of time/predetermined number of bytes indicated by CDS 170. Further, filtering may be a multi-step process in which Gateway 152 first filters static content or content data elements in Gateway 152, and, second, filters content based on the predetermined amount of time/predetermined number of bytes for transmission. Rather than, or in addition to, a time and/or bytes for transmission, an embodiment is directed to filtering according to whatever metric is used to determine billing for services provided by Gateway 152 to CDS 170.

In one embodiment, the suppression of and determination of static content can be according to an issuer's perspective. For example, as stated above, Gateway 152 can determine the amount of content to filter based on a time for transmission or an amount of bytes for transmission to CDS 170. The more dynamic content can have a heightened priority for transmission. An issuer of CDS 170 can indicate to Gateway 152 that no transmission should take longer than a predetermined amount of time or a predetermined number of bytes, or both. An issuer for the purposes herein refers to an issuer of CDS 170 to end users. For example, American Express may issue smart cards to users, and under an agreement or for other reasons provide that the smart card contain a cache of a predetermined website, such as Yahoo.com. Further, American Express can provide that certain websites are downloaded faster to the smart cards via Gateway 152. In one embodiment, the issuer communicates with Gateway 152 to supply information concerning the predetermined amount of time, number of bytes and content of the cache on a smart card.

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In one embodiment, the content data elements and/or groups of content data elements appropriate for filtering are determined according to an indication of the content provider regarding whether the content is static. In another embodiment, the content data elements appropriate for filtering are determined dynamically by the Gateway by software adapted to determine whether content is cached in CDS 170. For example, an embodiment can include a setup program in one or both of Gateway 152 and CDS 170 that identifies particular web pages as pre-loaded in CDS 170 and can further include updating parameters for allowing transmission of previously identified static content data elements or groups thereof according to, for example, a schedule. The setup program may further include other filtering parameters regarding types of content for filtering, such as content that a user of CDS 170 identifies according to the user's level of interest. The setup program can further identify content that allows a reduced web page to be displayed on CDS 170. In other embodiments, Gateway 152 is configured to dynamically determine whether content for transmission to CDS 170 should be filtered. Gateway 152 can include a software program that receives web pages for transmission to CDS 170 and determines according to a history of previously transmitted web pages to CDS 170 any appropriate content data elements to be filtered. Further, Gateway 152 in cooperation with CDS 170 can dynamically determine appropriate content data elements or groups thereof for filtering.

In one embodiment, the method described in Fig. 2A is consistent with the embodiment of Fig. 2B. CDS 170 receives the filtered content and can load any static content filtered from the transmission from a static cache within CDS 170. Alternatively, for content that is filtered that the CDS 170 determines is not required, such as content identified by a user as not important to the user, a loading of static content, such as shown in block 260 of Fig. 2A is avoided. For example, a web page with undesired static content can be displayed on CDD 172 as a reduced web page including only fields that are important to the user.

Advantageously, the embodiment described in Fig. 2B enables transmission of managed content without requiring a web server, such as server 130 to apply caching rules or to abide be a protocol requiring, for example, a static cache identifier or the like.

Referring now to Fig. 3, one embodiment of the invention is directed to a wireless environment, for example, a wireless environment following a wireless transmission standard

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such as Bluetooth or 802.11b or the like. In an embodiment, a wireless network 310 couples a Wireless Application Protocol (WAP) gateway server platform 331 running a WAP gateway server 330 to a mobile WAP browser 312. WAP gateway server 330 is coupled to receive web pages, such as pages 340 and 350, each are shown as a full Wireless Markup Language (WML) page holding, for example, 20 Kbytes of data 340, and a dynamic WML page 350 holding, for example 2 Kbytes of data. The web pages 340 and 350 may be received by other networks 311 or be generated from within network 311. WAP gateway server 330 sends and receives data from CDS 170, which is representative of one or more CDS 170. Further, the other networks 311, may be wireless, twisted pair or otherwise.

CDS 170 shown in Figs. 1A, 1B and 3 may operate under a WAP standard transmitting and receiving WML pages when CDS 170 is implemented as a mobile phone or personal digital assistant (PDA) or the like coupled to a wireless network 310. The modulation used for wireless networks may include Time Division Multiple Access, (TDMA), Code Division Multiple Access (CDMA), or iDEN. Each of these transport modulation technologies requires an application protocol, such as the Wireless Application Protocol (WAP). Using WML templates, web designers produce web pages for presenting data to WML devices. Some web pages using WML are flat files, but more often they are templates for the presentation of dynamic data. WML devices, such as mobile telephones, CDD 172 and the like, may include specialized web browsers, such a microbrowsers that are permanently installed during a manufacturing process. For example, CDD 172 may include a microbrowser that uses the telephone's screen to display web pages served in the wireless markup language (WML). Other known microbrowsers include AT&T's™ PocketNet™ service, and Bell Atlantic Mobile's™ Cellscape™.

Wireless network 310 couples WAP gateway server 330 running on gateway server platform 331 to CDS 170. CDD 172 runs CDS 170, including browser 312 and cached WML or other data of a web page 360. CDS 170 is shown as included in CDD 172. However, as shown, CDS 170, including browser 312 optionally are included on a smart card 320 coupled to CDD 172. CDS 170, holds a browser 312, which may be implemented as a mobile WAP browser, a microbrowser or reduced instruction set browser of a size chosen by a user or may be a fixed size microbrowser burned into the device in manufacturing. CDS 170 can be within CDD 172 or be stored on a smart card 320 coupled to CDD 172. Thus, the device may be coupled to a removable or permanent smart card 320 that holds browser 312 or is

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coupled to browser 312. In one embodiment, CDD 172 is implemented as a cell phone and smart card 320 is implemented as a subscriber identity module (SIM).

In general, a smart card for purposes herein is a device with a microprocessor or memory embedded therein. The memory may store electronic data and/or programs. A smart card may include enough processing power to serve many different applications. A smart card may be a memory card that stores data and may include security features. A smart card may also be a microprocessor card capable of adding, deleting and/or manipulating content and information in a memory on the smart card. A smart card may be akin to a miniature computer, with an input/output port, operating system, and EEPROM with optional built-in security features.

In the embodiment, smart card 320 includes static content of a web page 360, such as a web page. The static content 360 held in smart card 320 may be personalized according to a user's requirements. In one embodiment, a content provider for a web site, such as www.yahoo.com may subsidize the smart cards to promote access to www.yahoo.com. For example, Yahoo!® might subsidize the inclusion of the static content of web site on a smart card. The subsidizing or other arrangement to preload a smart card advantageously provides a faster loading time for a user. Thus, a user may select Yahoo!® as a default portal, thereby guaranteeing that the web site will receive more "hits" or be used more often, which will affect the prices a web site may dictate for advertising expenses. Additionally, the caching methods for only newer content on the web site provides an efficient added benefit, or "value add," for the consumer. Other web sites, or competing portals, may receive less traffic from users with pre-loaded smart cards because the loading time and cost would be greater. For example, a competing portal such as Alta Vista® at www.altavista.com, would necessarily load more slowly since no content is locally cached, and at much greater expense if there is a charge for data transmission.

In addition, WAP gateway server 330, in one embodiment, has a relationship with the default portal or content provider such that pre-loaded or dynamically loaded static content on smart card 320 is known by WAP gateway server 330 and is recorded in a container, such as a static file list, a database, or pre-load file list or the like.

Additionally, security aspects of a smart card may provide significant advantages for certain static content. For example, static content personalized in the card could include

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secret keys used for cryptography, where the risk of compromising the keys is greatly reduced by storing the keys in a highly secure smart card.

The smart card may be used with a mobile telephone or a personal digital assistant as described above. In one embodiment, embodiments of the caching system described herein provide an economical method of downloading content when downloading is priced on a per byte basis. For example, mobile telephone users may pay for each block of downloaded content, at $.05 per 256 bytes. With the embodiments described, smaller content downloads are less expensive. Thus, a preloaded smart card can save the end user a considerable amount of money in transmission fees when accessing the cached web site.

In operation, without a smart card 320 in accordance with an embodiment, when browser 312 accesses or attempts to access a particular web page, browser 312 typically must load the full web page 20 via the WAP gateway server 330 through the wireless network 310. A web page may require loading of, for example, 20 Kbytes of content into CDS 170. If smart card 320 is present, however, the browser 312 first detects that the static portion of the web page 360 is available on smart card 320, and downloads only the 2 Kbytes of dynamic web page 350.

The browser 312 in CDS 170, according to an embodiment, differentiates web pages according to characteristics of the content. More particularly, as shown, CDS 170 may include a removable or fixed smart card 320 with static portions of various web pages personalized into smart card 320. Thus, static content need not be downloaded unless the content changed. Upon reference to such a web page, only the dynamic web content requires downloading. The static content read from the smart card completes the web page. If the static content in the smart card has changed, it may be downloaded to update the card if the card has been set up to accept a modification. In one embodiment, a user of CDS 170 may have a contractual relationship or other relationship with WAP gateway server 330. According to the relationship setup between the user or client and WAP Gateway 330, a setup program can determine whether static content needs to be downloaded to the CDS 170, thereby avoiding, at least in part, the determination regarding whether or not cached content is present in the smart card. Thus, if WAP gateway server 330 has a container identifying static content, for example, WAP gateway server 330 transmits only content that does not

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include content known by WAP gateway server 330 as being present in the smart card or CDD 172 cache.

Referring to Fig. 4, a web page 400 is shown that is appropriate for identifying content characteristics for caching purposes. As shown, web page 400 includes a plurality of different content subsections with different characteristics. For example, the content identified as 410 includes items of content that may be predetermined by a content provider as static content. In this context, static content may mean content that may very infrequently require an alteration. As shown, the Yahoo!® label, and the icons for Calendar, Messenger, Check Email, What's New, Personalize, and Help are included in block 410. These items may be determined to be required indefinitely, or at least require a major overhaul of the web page before any changes would be made to the content. Accordingly, an embodiment of the present invention would be directed to identifying block 410 as static content in a template for the web page. Thus, a unique identifier may apply to identify the static content on the template for the web page. A user downloading the web page that loads the unique identifier, such as a static content identifier, may then check a static cache index and load the content from a static cache instead of from the web page. Prior art web page downloading requires downloading an entire web page when a single change occurs in the web page. Advantageously, a user loading from cache for a portion of the web page avoids downloading an entire web page when one or more portions of the web page is identified as static. In a prior art web page, a single change to advertisement 412 would require downloading of the entire web page. According to an embodiment, only non-static portions of a web page designed in accordance with an embodiment require downloading when a user holds cached content of the unchanged portion(s).

For example, referring to item 412, an advertisement is identified. The advertisement may be content on the web page that often requires updating. Accordingly, an embodiment of the invention is directed to identifying item 412 as dynamic content, or content that does not have a unique identifier assigned to it because it will be downloaded at each access. In another embodiment, for example, if the advertisement is periodically changed, the advertisement 412 may have a unique identifier that lasts for as long as the period. An advertiser may pay for a six-month lease of the space on the web page, for example, and so, the content provider may provide for a unique identifier that expires after six months. After the unique identifier expires, the content appears to a user as dynamic content for which no

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check of a cache index is required. In another embodiment, the advertisement may have a unique identifier that changes every few hours, in cases for which an advertiser has a plurality of related advertisements that may each be associated with a unique identifier, the cache toggling or rotating the displayed cache version, for example.

5   Fig. 4 also shows a block 420, which is entitled "In the News." Block 420 includes a plurality of links that are news items deemed of interest for a particular day or week or the like, as determined by a content provider. In one embodiment, the block 420 would not require a unique identifier because the content would be assumed dynamic. In another embodiment, depending on caching memory systems assumed in use on a user's platform a
10   unique identifier may be a daily identifier for implementations in which the unique identifier is useful for users that frequently visit the web page in excess of a predetermined number of times per day.

       Referring to blocks 430 and 440, a plurality of links is shown for which a different unique identifier may be assigned. More particularly, the material within block 430 may be
15   more or less static than the items identified by block 410 or the advertisement 412. For example, the items 430 and 440 may include links that require alteration once per year, which is less often than a short-term advertisement, but more often than icons that are inherent or require no or minimal changes for long periods. Thus, blocks 440, 430, 420, 412 and 410 provide a plurality of hierarchies of content in web page 400 for which different caching
20   strategies may be employed with the benefit of this disclosure.

       Still referring to Fig. 4, in one embodiment, web page 400 may be an HTML, XML or other markup language file written or rewritten as a linked set of files, some of which contain dynamic content, which may include the links provided in block 420, and others containing only static content, such as the items included in block 410. Further, in the embodiment, each
25   web page included in the linked set of files that holds static content may be marked with a unique identifier, such as a standard globally unique identifier (GUID). The unique identifier, in one embodiment, ensures that the correct static content is always referenced, with no possibility of a name conflict.

       According to one embodiment, when web page 400 is loaded, the linked set of files
30   references and downloads the dynamic files 420 using conventional links. These files 420 contain references for unique identifiers to each of the static files, such as items 410, that load

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into various places in the web page. Each identified static file is downloaded and cached, for example, with a unique identifier stored in a standard local database, such as a cache index. The cache index identifies which static files or static content data elements are present in the cache. If a cache system provides that files, data elements, groups of data elements and cache

5   content be removed under predetermined circumstances, for example, size limitations or to reduce the cache space used, the cache index or database reflects when the files, data elements or cache content are removed from the cache. In an embodiment, for example, cache may have limited storage capacity, for example, in a readable/writeable memory. Thus, a method for caching with limited capacity may include comparing predetermined

10 characteristics of stored content in the cache with characteristics of newly received content, the newly received content for storing in the cache, the comparing to locate stored content with predetermined characteristics, and replacing stored content with the predetermined characteristics with the newly received content in the cache. The predetermined characteristics in the stored cache may include one or more of a need for the stored content,

15 an importance for the stored content, a cost-benefit numeric assigned to the stored content, a statistical numeric related to the need for the stored content, a mark associated with a user's desire to retain the stored content, and a characteristic identifying the stored content as unnecessary. Also, in an embodiment, the cache content can be replaced based on one or more attributes of the cache rather than the content. For example, the Least Frequently Used

20 (LFU) and/or the Least Recently Used (LRU) algorithms, or other metric identifying frequency of access, time or date of the last access may be applied to the cache to discard or replace stored content in the cache irrespective of the content being removed.

When the web page 400 is subsequently reloaded, the dynamic files, such as items 420 are reloaded also. However, in an embodiment, any unique identifier references in any

25 of the dynamic files or container identifying dynamic content is compared against the local database to determine if that particular data content referenced by that unique identifier is present. Because dynamic files 420 may have been stored in the cache earlier, the unique identifier(s) is used to reload the file from the cache matching that unique identifier(s) instead of downloading the identified content from the remote system. Using the cached content

30 identified by the unique identifier dramatically decreases the download time. Further, the embodiment advantageously provides a web page designer or content provider with flexibility, since if it later becomes necessary to change a portion of the web page which had formerly been cached, the changed version need only be assigned a new unique identifier.

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When the page is later downloaded, the new unique identifier will trigger a download of the changed page.

In one implementation of the embodiments described with reference to Fig. 4, a change is called for by a standards body to a standard. For example, any standard covering the format of data for transmission as a web page would accommodate the unique identifier described herein. In one embodiment, the standard may add a flag and a unique identifier for a data file for holding static content, the unique identifier labels the static content. In an embodiment, the assigned unique identifier corresponds to the identified static content indefinitely. Thus, if the static content is no longer needed, the unique identifier is abandoned. The unique identifiers are not reused. For example, in one embodiment, the unique identifier may have a 128-bit address base corresponding to a plethora of available unique identifiers. The standard would therefore enable the data file to exist such that the unique identifier(s) and static content define the file.

In one embodiment, the methods described above with respect to Fig. 4 are directed to cooperation between a gateway, such as Gateway 152 and CDS 170, both shown in Fig. 1. In this embodiment, a change by a standards body to a standard is not required. Rather, only Gateway 152 and CDS 170 use the unique identifiers. Thus, a web server would remain unaware of the use of unique identifiers associated with static and dynamic content. Specifically, a web server transmits a Web page without unique identifiers to Gateway 152. If the web page is one for which Gateway 152 holds a recorded list unique identifiers, for example as a static file list, Gateway 152 filters the web page content according to the static content in the recorded list. After filtering, Gateway 152 inserts unique identifiers in the content for the benefit of CDS 170. The unique identifiers mark the content to enable CDS 170 to insert cached content. Then, Gateway 170 transmits the filtered and marked content. The transmitted content can include a reduced version of the web page reduced by filtering and by contractual agreements between Gateway 152 and CDS 170.

Referring to Fig. 5, a flow diagram illustrates a method appropriate for one or more embodiments. Block 510 provides for determining one or more characteristics of content to be transmitted. Block 520 provides for identifying the content into at least a first subset according to the identified characteristic of the content, the identifying enabling caching of at least the first subset of the content according to the identified characteristics. In one

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embodiment, the identified characteristics include a static characteristic and a dynamic characteristic. The static characteristics of content on a web page are determined including all levels of hierarchy in the web page. In one embodiment, the identifying is performed by a content provider.

5   In another embodiment, rather than a content provider providing the unique identifiers for content, a consortium of, for example, tool developers for web pages, such as Cold Fusion™ may provide the unique identifiers. Specifically, referring back to Fig. 4, a block 450 is identified as a query box for a user to enter a search query. A button "Search" is provided on the web page for a user to click after entering a search query. According to an

10   embodiment, a consortium of software developers, or a lead software developer or a party with standardizing powers may identify the box and, perhaps, the "Search" button, as a universal item appropriate for a universal unique identifier. Other appropriate items for universal unique identifiers include simple .gifs, other graphics, common sounds, simple drawings, and other .gifs that are common on many web pages. The software developers or other party may provide a list of universal unique identifiers with corresponding common

15   items, as appropriate, to content providers, web developers and any party that makes decisions as to unique identifiers. A content provider may then apply the universal unique identifier for those items. Thus, certain predetermined unique identifiers, such as universal unique identifiers may be standardized by a standards body.

20   In addition, a tool developer could select a set of unique identifiers for the static content produced by the particular tool when constructing web pages. In this case, all web designers using this particular tool would benefit from the unique static content produced. This static content would only have to be cached a single time in the client browser, regardless of the number of web pages accessed that were constructed using this tool.

25   Referring now to Fig. 6A, a method for a gateway to manager content for transmission, such as Gateway 152, is illustrated. Specifically, block 611 provides for determining a plurality of characteristics of content, including at least one static characteristic of content. The determining can be performed by the Gateway 152, or another entity. Block 621 provides for sharing the determination of the plurality of characteristics of content with

30   the gateway and the one or more clients. In one embodiment, the sharing enables the gateway to filter content for transmission to the one or more clients based on the plurality of

characteristics and the static characteristic of content thereby reducing an amount of content transmitted between the gateway and the one or more clients.

One embodiment includes optional block 625, which directs that the gateway insert unique identifiers into the filtered content. The unique identifiers mark the filtered content for the client to insert cached content identified by the unique identifiers. In other embodiments, only a portion of the filtered content requires cached content to be added, thereby allowing for the client to display a reduced web page, for example.

Block 631 provides for updating the gateway with a later determination of the plurality of characteristics of content, the updating including adding data to a container identifying data elements, wherein the container is associated with the gateway.

Referring now to Fig. 6B, a method of managing content is shown from a client perspective. Block 610 provides for reading a unique identifier, the unique identifier identifying content for caching according to at least one characteristic of the content. Block 620 provides for comparing the unique identifier to the contents of a cache index to determine if the content is stored in a cache. Block 630 provides that if the cache is independent of the content, the content is downloaded. In one embodiment, one or more of the cache, cache index and browser is located in a smart card, such as that shown in Fig. 3.

Other Embodiments

While specific embodiments of the present invention have been described, various modifications and substitutions will become apparent to one skilled in the art by this disclosure. Such modifications and substitutions are within the scope of the present invention. For example, an embodiment may be directed to a logging environment, a satellite communication environment or other environments for which bandwidth reductions, efficiency and cost are important.

Unlike conventional caching systems, embodiments of this invention include unique identifiers associated with specific content. A conventional system might have multiple copies of the exact same content being cached as associated subfiles of various documents, with no way to determine that the subfile contents are indeed identical. In accordance with an embodiment, a cache need only have a single copy of any unique content, marked with a unique identifier, regardless of the number of different documents that are accessed which

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include this content. Indeed, such unique content need only be downloaded a single time. New documents downloaded which reference this same unique content need not download this content even a single time.

Thus, many different areas can benefit from embodiments disclosed herein. For example, if a data log uses a particular static frame to display the graph, the static frame can be marked with a unique identifier and cached, and need never be loaded again when displaying this data. Similarly, stock data is often displayed on static graphs with particular time scales. The static graph for a given time scale could be marked and cached, making subsequent displays on the same time scale much faster. With certain video transmissions, a channel logo appears in the corner of the display, such as the logo associated with the Disney® Channel. The logo could be cached at the receiver, thus avoiding the transmission of the logo with every video frame. Indeed, virtually all documents have some kinds of static components, such as company logos, and could benefit from marking and caching such static components, reducing transmission times for these documents.

One or more of the embodiments described above provide for the use of a server, server, or other type of computer system. A computer system of any appropriate design, in general, including a mainframe, a mini-computer, such as a hand-held device or a personal computer system, may be used to practice the present invention. Such a computer system typically includes a system unit having a system processor and associated volatile and non-volatile memory, one or more display monitors and optional keyboards. Some computer systems may include one or more diskette drives, one or more fixed disk storage devices and one or more printers. These computer systems are typically information handling systems which are designed to provide computing power to one or more users, either locally or remotely. Such a computer system may also include one or a plurality of input / output (I/O) devices (i.e., peripheral devices) which are coupled to the system processor and which perform specialized functions. Examples of I/O devices include modems, sound and video devices and specialized communication devices. Mass storage devices such as hard disks, CD-ROM drives and magneto-optical drives may also be provided, either as an integrated or peripheral device. One such example computer system is shown in detail in Fig. 7.

Fig. 7 depicts a block diagram of a computer system 10 suitable for implementing at least a portion of the present invention. Computer system 10 includes a bus 12 which

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interconnects major subsystems of computer system 10 such as a central processor 14, a system memory 16 (typically RAM, but which may also include ROM, flash RAM, or the like), an input/output controller 18, an external audio device such as a speaker system 20 via an audio output interface 22, an external device such as a display screen 24 via display

5   adapter 26, serial ports 28 and 30, a keyboard 32 (interfaced with a keyboard controller 33), a storage interface 34, a floppy disk unit 36 operative to receive a floppy disk 38, and a CD-ROM player 40 operative to receive a CD-ROM 42. Also included are a mouse 46 (or other point-and-click device, coupled to bus 12 via serial port 28), a modem 47 (coupled to bus 12 via serial port 30) and a network interface 48 (coupled directly to bus 12). As will be

10   appreciated, computer system 10, if implemented in a hand-held device will have limited space for each component described above, and will be independent of many of the devices herein described.

Bus 12 allows data communication between central processor 14 and system memory 16, which may include both read only memory (ROM) or flash memory (neither shown), and

15   random access memory (RAM) (not shown), as previously noted. The RAM is generally the main memory into which the operating system and application programs are loaded and typically affords at least 16 megabytes of memory space. The ROM or flash memory may contain, among other code, the Basic Input-Output system (BIOS) which controls basic hardware operation such as the interaction with peripheral components. Application

20   programs resident with computer system 10 are generally stored on and accessed via a computer readable medium, such as a hard disk drive (e.g., fixed disk 44), an optical drive (e.g., CD-ROM player 40), floppy disk unit 36 or other storage medium. Additionally, application programs may be in the form of electronic signals modulated in accordance with the application and data communication technology when accessed via network modem 47 or

25   interface 48.

Storage interface 34, as with the other storage interfaces of computer system 10, may connect to a standard computer readable medium for storage and/or retrieval of information, such as a fixed disk drive 44. Fixed disk drive 44 may be a part of computer system 10 or may be separate and accessed through other interface systems. Many other devices can be

30   connected such as a mouse 46 connected to bus 12 via serial port 28, a modem 47 connected to bus 12 via serial port 30 and a network interface 48 connected directly to bus 12.

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Regarding the signals described herein, those skilled in the art will recognize that a signal may be directly transmitted from a first block to a second block, or a signal may be modified (e.g., amplified, attenuated, delayed, latched, buffered, inverted, filtered or otherwise modified) between the blocks. Although the signals of the above described embodiment are characterized as transmitted from one block to the next, other embodiments of the present invention may include modified signals in place of such directly transmitted signals as long as the informational and/or functional aspect of the signal is transmitted between blocks. To some extent, a signal input at a second block may be conceptualized as a second signal derived from a first signal output from a first block due to physical limitations of the circuitry involved (e.g., there will inevitably be some attenuation and delay). Therefore, as used herein, a second signal derived from a first signal includes the first signal or any modifications to the first signal, whether due to circuit limitations or due to passage through other circuit elements which do not change the informational and/or final functional aspect of the first signal.

Those skilled in the art will also appreciate that embodiments disclosed herein may be implemented as software program instructions capable of being distributed as one or more program products, in a variety of forms including computer program products, and that the present invention applies equally regardless of the particular type of program storage media or signal bearing media used to actually carry out the distribution. Examples of program storage media and signal bearing media include recordable type media such as floppy disks, CD-ROM, and magnetic tape transmission type media such as digital and analog communications links, as well as other media storage and distribution systems.

Additionally, the foregoing detailed description has set forth various embodiments of the present invention via the use of block diagrams, flowcharts, and/or examples. It will be understood by those skilled within the art that each block diagram component, flowchart step, and operations and/or components illustrated by the use of examples can be implemented, individually and/or collectively, by a wide range of hardware, software, firmware, or any combination thereof. The present invention may be implemented as those skilled in the art will recognize, in whole or in part, in standard Integrated Circuits, Application Specific Integrated Circuits (ASICs), as a computer program running on a general-purpose machine having appropriate hardware, such as one or more computers, as firmware, or as virtually any combination thereof and that designing the circuitry and/or writing the code for the software

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or firmware would be well within the skill of one of ordinary skill in the art, in view of this disclosure.

Although particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that, based upon the teachings herein, changes and modifications may be made without departing from this invention and its broader aspects and, therefore, the appended claims are to encompass within their scope all such changes and modifications as are within the true spirit and scope of this invention.